Introduction:

VCL-GPS, GPS Grandmaster Clock Synchronization Receiver with IEEE-1588 protocol is a high precision, yet cost efficient, time and frequency synchronization solution which can be used to synchronize the time-of-day and frequency across all nodes of the network (using IEEE-1588 Master-Slave protocol) from a GPS referenced source. The VCL-GPS Receiver also has an integrated, high bandwidth NTP Server engine that is capable of handling up to 3000 NTP requests per second. Multiple IRIG-B Outputs are also provided to synchronize local clock displays as well as RTUs to a central timing source with nanosecond accuracy.

The VCL-GPS, GPS Receiver is specifically designed for the synchronization of 2G, 3G and LTE mobile telecommunications networks as well as backhaul wire-line SDH / SONET and Synchronous Ethernet networks. It may be also used by Railways, Airports (including air-traffic control), power generation and distribution companies and other utility companies who not only require a highly precise time-of-day and frequency synchronization locked to a GPS Reference but who also need to distribute highly precise time-of-day and frequency synchronization across all nodes of their networks.

The equipment conforms to and provides a G.811 / Stratum 1 stability OCXO Holdover Clock. Provides 1PPS, NMEA, 1/5/10MHz, 2.048MHz, 2.048Mbits outputs. OCXO and Rubidium Holdover Clock options available.

Available in two Version:

1. GPS, PTP IEEE-1588v2 Grandmaster and Primary Reference Clock

   **Product:** Primary Reference (PRC) Clock GPS Receiver

   **Description:**
   - (i) GPS Receiver and Primary Reference (PRC) Clock. Provides 1PPS, NMEA, 1/5/10 MHz, 2.048 MHz, 2.048 Mbits with SSM, 1.544 Mbits Frequency Outputs with High Stability OCXO Holdover Clock. Rubidium option available.
   - (ii) GPS Grandmaster (IEEE-1588v2) and Primary Reference Clock with NTP Server IEEE-1588v2 Grandmaster and Primary Reference Clock with NTP Server (IPv4 and IPv6). Provides IRIG-B, 1PPS, NMEA, 1/5/10 MHz, 2.048 MHz, 2.048 Mbits with SSM, 1.544 Mbits GPS referenced outputs. OCXO and Rubidium Holdover Clock options available.

2. PTP (IEEE-1588v2) Slaves

   **Product:** PTP (IEEE-1588v2) Slave for ToD (Time of Day) and Frequency Synchronization

   **Description:**
   - (i) PTP (IEEE-1588v2) Slave - synchronizes to PTP Grandmaster to provide IRIG-B, 1PPS, NMEA, 1/5/10 MHz, 2.048 MHz, 2.048 Mbits outputs. OCXO and Rubidium Holdover Clock options available.
   - (ii) PTP (IEEE-1588v2 Slave) for ToD (Time of Day) Synchronization. PTP (IEEE-1588v2 Slave) synchronizes to PTP Grandmaster to provide IRIG-B, 1PPS, NMEA, 2.048 MHz, 2.048 Mbits outputs.

Features and Highlights:

- Reliable, Cost-Efficient Reference GPS Receiver
- 50 Channel GPS, L1 frequency, C/A Code Receiver
- Simultaneous tracking of up to 12 GPS satellites
- Primary Reference (PRC) Clock
- IEEE-1588v2 Precision Time Protocol Grandmaster
- Support for up to 32 PTP Clients
- Nanosecond accuracy
- Primary Reference Clock for Frequency Synchronization
- GPS locked G.703 compliant E1, 2.048 Mbits, 1.544 Mbits and 2.048 Mhz outputs
- High stability and holdover functionality:
  - ITU-T G.811 / Stratum 1 compliant (PR) Primary Reference when locked to GPS
  - ITU-T G.812 (Type I, V, VI) compliant holdover
- SSM Message format - Compliant with ITU-T G.704. Optional GR-378-CORE for SONET Networks. 10 MHz output
- 1 PPS output
- IRIG-B output
- Standard RJ45 and BNC connectors for all inputs and outputs
- ToD compliant to NMEA 0183 (DB9 Serial Port).

Additional Features:

- High bandwidth NTP Server
- Separate, independent, IEEE-1588 and NTP Server engines
- IPv4 and IPv6 compatible NTP Server
- SSH, Telnet, Radius, SNMP V2 MIB
- Password Protection
- Redundant AC and DC power supply options
- 4, 10/100/1000BaseT Network Interface Ethernet Ports
- 2 x 10/100/1000BaseT Network Interface Ethernet Ports
- 2 x 1000BaseSX/LX Network Interface Ethernet Ports
- VLAN and Packet priority feature - allows the user to assign priorities to different types of clients
- Supports QoS, 802.1p based packet priority.
- Supports 802.1Q based VLANs.
- Power Contact and Lightning Protection as per Telcordia GR-1089-CORE.

Application Diagram:

![Application Diagram Image]
**Standard Frequency and ToD Outputs:**

<table>
<thead>
<tr>
<th>Output Type</th>
<th>Number Of Outputs</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.544 Mbit/s (T1) compliant with ITU-T G.703</td>
<td>8 (8 T1)</td>
<td>RJ45</td>
</tr>
<tr>
<td>2.048 Mbit/s (E1) compliant with ITU-T G.703</td>
<td>8 (8 E1)</td>
<td>RJ45</td>
</tr>
<tr>
<td>2.048 MHz, 75 Ohms, phase-locked to GPS</td>
<td>8</td>
<td>BNC</td>
</tr>
<tr>
<td>10 MHz, 50 Ohms, phase-locked to GPS</td>
<td>1</td>
<td>BNC</td>
</tr>
<tr>
<td>IRIG-B, synchronized to GPS**</td>
<td>8</td>
<td>BNC</td>
</tr>
<tr>
<td>1 PPS, phase-locked to UTC**</td>
<td>1</td>
<td>BNC</td>
</tr>
<tr>
<td>TOD (Time-of-Day) output compliant to NMEA0183</td>
<td>1</td>
<td>DB9, RS-232C</td>
</tr>
</tbody>
</table>

*ToD* Time Of Day

**Note:** User selectable between IRIG-B and 1PPS Outputs

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**IEEE-1588v2 Server:**

- Compliant with IEEE-1588 v2 (2008) specifications
- Maximum number of addressable PTP Clients - 32

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**Technical Specifications**

**GPS Receiver:**

- 50 Channel GPS Receiver
- GPS L1 frequency, C/A Code Receiver
- Tracks up to 12 satellites simultaneously
- Synchronizing Time:
  - Cold Start (includes almanac acquisition time): 27 seconds
  - Time-To-Fix (almanac acquisition already completed): 1 second
  (Note: with all satellites in view at -130db)
- GPS Signal
  - Tracking and Navigation: -162 dBm
  - Reacquisition: -160 dBm
  - Cold Start: -148 dBm
- Antenna Connector: SMA
- Accuracy Of Time-Pulse Signal referenced to GPS: ± 30ns (raw)
- Accuracy Of Time-Pulse Signal referenced to GPS: ± 15ns (compensated)
  (Note: with all satellites in view at -130db)

**Internal Synchronization Options:**

- Rubidium
- OCXO (Oven-Controlled Crystal Oscillator)

**External Frequency Synchronization Inputs:**

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**NTP Server:**

- NTP Protocols: NTP v2 (RFC 1119), NTP v3 (RFC 1305), NTP v4
- IP Protocols: IPV4, IPV6
- Time Protocol: (RFC 868)
- Daytime Protocol: (RFC 867)
- Synchronization of IEC 61850 compliant devices using SNTP protocol
- Capable of processing up to 3000 requests per second

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**System Access, Control and Management Options:**

- RS-232C Connector
- USB Connector
- 10/100BaseT Ethernet
- 1 x External Alarm Relay Contact

**Security and Protection:**

- Password Protection
- Secured Access via SSH V2
- Separate VLAN on monitoring and access

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**Configuration and Monitoring Software:**

- Telnet, CLI
- GUI (Graphical User Interface) - Runs on any PC operating on Windows XP, Windows 7 or Windows 8 OS.

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**Power Supply Options:**

- Dual Redundant
- 1+1 AC power (100 to 240V AC, 50/60 Hz)
- 1+1 DC 24V power
- 1+1 DC -48V power
- 1+1 DC 110/125V DC power
- AC plus DC (AC + DC), AC or DC.

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**Typical Synchronization Applications:**

- Synchronizing Cellular networks eg, UMTS, GPRS, 3G and LTE
- Power generation and distribution companies and other utility companies
- Wireless and Wireline Telecom synchronization
- Distributing Time (ToD) and Frequency reference for power utilities across all nodes of the network
- Synchronization of Defense Networks
- Synchronizing airports and aviation communications
- Synchronizing railway signaling networks and railway communications
- Synchronizing traffic management
- Broadcasting Network and Broadcast equipment synchronization.

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